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(54) Title: VEHICLE LOCATION SYSTEMS

(57) Abstract

A vehicle location system comprises a central controller and a plurality of mobile vehicles. The controller transmits job request messages to the mobile vehicles and these messages include information about the location of a job. Each vehicle has a receiver, a transmitter, and a means to compare the requirements of the job with the status of the vehicle. If the result of the comparison is that the vehicle is suitable for the job then it transmits a message back to the controller volunteering it for the job.



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# VEHICLE LOCATION SYSTEMS

This invention relates to job allocation in an automatic vehicle location system.

Automatic vehicle location systems are commonly used to control vehicle operations by Taxi fleets, Distribution Organisations, Emergency Services, etc. Conventional location systems enable a controller to keep track of the location of the vehicles in a fleet and to use this information in allocating a job to a particular vehicle. Information other than the location of a vehicle is usually needed in deciding which vehicle will perform a job. This information will also need to be monitored by the controller. The location information may in some situations need to be continuously monitored. In large vehicle fleets this is not a reasonable proposition if a single radio channel is all that is available for transmission of data. For example, a taxi may move at an average speed of 10m/s. In allocating a job in a crowded city centre, a precision of as little as 100m may be needed for the location of a vehicle. Thus a positional update every 10s would be needed from each vehicle in a fleet. This represents much more data than could be accommodated in a single radio data channel.

The present invention provides a method of job allocation for an automatic vehicle location system having a controller and a plurality of mobile vehicles with a two-way radio link between the controller and the vehicles, the method comprising the steps of transmitting a message from the controller to the vehicles the message including information about the job location, comparing at each vehicle the requirements of the job with the status of the vehicle and, if the result of the comparison is such that the vehicle is suitable for the said job, transmitting a response message from the vehicle to the controller.

In accordance with the invention there is also provided a job allocation system for use with an automatic vehicle location system comprising a central controller, transmitting means at the controller, receiving means at the controller, a plurality of mobile

vehicles each vehicle including means to receive job request messages from the controller, means to compare the requirements of the requested job with the status of the vehicle, and means to transmit a response message to the controller if the result of the comparison is such that the vehicle is suitable for the job.

Furthermore, the invention provides apparatus for use at a mobile vehicle in an automatic vehicle location system comprising means to receive a job request message, means to compare the requirements of the requested job with the status of the vehicle, and means to transmit a response message to the controller if the result of the comparison is that the vehicle is suitable for the job.

The invention is now described in more detail by way of example.

Various pieces of information are used by the controller of a fleet of vehicles when allocating jobs to specific vehicles. These may include the following:

1) The type of job and the vehicle and/or crew's ability to perform it;

2) The time when the job is to be performed and the availability of vehicles; and

3) The location of the job and the distance a vehicle would need to travel to the job.

There may well be other constraints effecting the selection of a vehicle for the job.

In the current invention, each vehicle in a fleet has a microcomputer to perform all the vehicle location tasks. In addition to this, the microcomputer is used to assess the suitability of the vehicle for a given job or task.

When the controller of the fleet receives a job request, it will broadcast a data message containing all the information relevant to carrying out that job to all the vehicles in the fleet. The microcomputer at each vehicle then assesses the suitability of the vehicle for the job in terms of location, and any other constraints in the data message. If the microcomputer decides that the vehicle is a suitable candidate for the job then it will transmit a response message back to the controller. This message to

the controller volunteers the vehicle for the job.

The information transmitted from the controller to the vehicles may contain such information as "only those within 100m need reply", or "only those with two hours available for the job need reply". These constraints might result in only one or two responses being transmitted and would thus cut down the amount of radio traffic. The effect of interrogating the vehicles in this manner is to create an intelligent distributed database.

There will be instances when there is more than one suitable contender for a job. One method of overcoming this problem would be to re-try the interrogation process at a pseudo-random time interval after finding more than one contender. There are however alternative and more efficient methods.

Firstly, the time which vehicles take to respond to an interrogation could be arranged to be proportional to the distance of the vehicle from the location of the job. Once a vehicle in the fleet has volunteered for the job then the other vehicles can be "stood-down" by the controller broadcasting a further message.

Secondly, the system could use a dynamic area window to minimise the number of responses received and thereby maximise the response time. This area window could vary with both time of day and job location. For example, in the west end of London on a Friday night there would be a high concentration of taxis and so a job would be offered only to taxis within a short distance of the job. Conversely, for a job in the east end of London, early on a Sunday morning, a large area would be used to find a taxi suitable for the job. The controller could be programmed to vary the area window with the time of day or could learn in an adaptive way depending on its success in getting responses.

The controller in the above system will normally have a gazeteer of street names against grid squares to enable job locations to be easily identified. Where roads are longer than the vehicle density the gazeteer will not always be satisfactory. The vehicle location system could therefore be adapted to improve the quality of its gazeteer as more jobs are performed. Since the controller knows the address of a job location (e.g. 61 High Street) it can interrogate the vehicle for its exact location when arriving

at the job location. This could be stored in memory and used for reference in future calls. Thus a fairly crude gazeteer can be self-refining.

The above invention is intended to be of use with any automatic vehicle location system.

In a conventional system in which the selection of a vehicle is done centrally, a fleet of 500 vehicles with a position update for each vehicle every 10 seconds would require 3000 messages every minute plus, say, one job allocation per minute. In a system in accordance with the invention the same job could be carried out with 1 offer, 1 acceptance, and 1 job details - a total of three messages.

CLAIMS

1. A method of allocation for an automatic vehicle location system having a controller and a plurality of mobile vehicles with a two-way radio link between the controller and the vehicles, the method comprising the steps of transmitting a message including information about the job location, comparing at each vehicle the requirements of the job with the status of the vehicle and, if the result of the comparison is such that the vehicle is suitable for the job, transmitting a response message from the vehicle to the controller.

2. A method according to claim 1, including the step of varying the time taken by a vehicle to transmit a response to a message from the controller in accordance with the distance of the vehicle from the location of the job.

3. A method according to claims 1 or 2, in which only vehicles within a predetermined area may respond to the message from the controller.

4. A method according to claim 3, in which the predetermined area is selected by and may be altered by the controller.

5. A method according to any preceding claim, including the steps of the controller interrogating a vehicle for its exact location on arrival at a job location, the vehicle transmitting its exact location to the controller, and the controller storing the exact location in memory thereby improving the quality of a gazeteer stored in memory.

6. A method substantially as herein described.

7. A job allocation system for use with an automatic vehicle location system, comprising a central controller, transmitting means at the controller, receiving means at the controller, a plurality of mobile vehicles each vehicle including means to receive job request messages from the controller, means to compare the requirements of the job with the status of the vehicle, and means to transmit a response message to the controller if the result of the comparison is that the vehicle is suitable for the job.

8. A system substantially as herein described.

9. Apparatus for use at a mobile vehicle in an automatic vehicle location system comprising means to receive a job request message, means to compare the requirements of the requested job with the status of the vehicle, and means to transmit a response message to the controller if the result of the comparison is that the vehicle is suitable for the job.

10. Apparatus according to claim 9, including means to vary the time taken to transmit a response to a job request message in accordance with the distance of the vehicle from the location of the job.

11. Apparatus substantially as herein described.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 88/00799

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC [4] G 08 G 1/00, H 04 B 7/26

## II. FIELDS SEARCHED

Minimum Documentation Searched [7]

| Classification System | Classification Symbols |
|---|---|
| IPC [4] | G 01-S, G 08 G, H 04 B |

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

## III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

| Category [10] | Citation of Document, [11] with indication, where appropriate, of the relevant passages [12] | Relevant to Claim No. [13] |
|---|---|---|
| X | Patent Abstracts of Japan, Vol. 9, No. 220 (E-341) abstract of JP 60-79842, 7 May 1985 *abstract* | 1,3,7,8,9 |
| Y | | 5,6 |
| Y | EP, A1, 0242099 (ADVANCED STRATEGICS, INC) 21 October 1987, abstract | 5,6 |
| A | Patent Abstracts of Japan, Vol. 9, No. 220 (E-341) abstract of JP 60-79846, 7 May 1985 *abstract* | 1-11 |

* Special categories of cited documents: [10]

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## IV. CERTIFICATION

| Date of the Actual Completion of the International Search | Date of Mailing of this International Search Report |
|---|---|
| 20th December 1988 | 19 JAN 1989 |
| **International Searching Authority** | **Signature of Authorized Officer** |
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# ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/GB 88/00799 SA 24395

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 02/11/88
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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| JP-A- 60079842 | 07/05/85 | None | |
| EP-A- 0242099 | 21/10/87 | JP 63024395 | 01/02/88 |
| JP-A- 60079846 | 07/05/85 | None | |